

Groundwater Low Flow Well Purging and Sampling

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Purpose of Well Purging

The purpose of well purging is to ensure that the water sample collected is representative of the groundwater quality in the geologic formation below the site.

Five Different Methods

- Standard fast recovery well
- Parameter based fast recovery
- Slow recovery well
- Non-purge
- Low flow

Standard fast recovery well

- Remove 3 borehole volumes of water.
- Allow the well to recover to 80% of its static condition prior to collecting the sample.

Parameter based fast recovery

- a. Remove 1 borehole volume of water.
- b. Conduct field water-quality measurements (dissolved oxygen, turbidity, specific conductance, and temperature).
- c. Remove $\frac{1}{2}$ borehole volume of water. Repeat the field measurements. If the first and second measurements vary by less than 10%, purging is considered adequate. Go to e. below.

Parameter based fast recovery (cont.)

- d. If greater than 10%, remove an additional $\frac{1}{2}$ borehole volume. Repeat the field measurements. If the second and third measurements vary by less than 10%, purging is considered adequate. Go to e. below. If not repeat process.
- e. e. Allow the well to recover to 80% of its static condition before collecting the sample.

Slow recovery well

- Remove 1 borehole volume of water.
- The well should be allowed to recover for 2 hours after purging has stopped. Then the well should be sampled as soon after 2 hours as possible.
- Note that if the well recovers to greater than 80% in less than 2 hours, it is a fast recovering well.

Non-purge

- The non-purge sampling method can be considered for wells that meet the following minimum conditions:
 - ◆ No NAPL exists in the well
 - ◆ Only applies to gasoline petroleum hydrocarbons
 - ◆ The well construction details are known and documented
 - ◆ The well is screened across the water table and
 - ◆ The well is properly developed.

Non-purge (cont.)

- Multiple events are required using both standard and non-purge methods.
- A formal request and certification that the non-purge method will provide representative water quality results.

Low-flow Purging Method

Basic Primus

- Aquifer heterogeneities affect contaminant flow paths (including variations in geology, geochemistry, hydrogeology and microbiology).
- The water in the screened section of the well in static conditions are representative of the formational conditions.
- Vertical variation in water quality in the formation will be reflected vertically in the screened section of the well.

Low-flow Purging Method

Defined

Low-flow refers to the velocity of the water entering the pump intake. Low-flow purging also results in limited drawdown.

Low-flow Purging Method

Maximum Pumping Rate and Drawdown

- Pumped at a constant flow rate of 0.1 to 1.0 liters per minute.
- Resulting in drawdowns of less than 0.10 meter or 0.33 feet during purging.

(The goal is to minimize drawdown and achieve a stabilized pumping water level as soon as possible.)

Low-flow Purging Method

Pump Placement

- **Dedicated pumps**

- ◆ This method is preferred due to the problems associated with the disturbance of the water column in installing the pump.

Low-flow Purging Method

Pump Placement (cont.)

■ Non-dedicated pumps

- ◆ Pump must be properly decontaminated prior to use.
- ◆ Extreme care needs to be taken to minimize disturbance of the water column in the well bore when installing the pump.
- ◆ A minimum of 2 hours is required after placement of pump to allow conditions to stabilize prior to sampling

Low-flow Purging Method

Sampling Location

- Screened interval ≤ 20 feet - A single point within the screened interval.
 - ◆ Homogeneous conditions
 - ◆ Petroleum – Upper 1/3 of screened interval
 - ◆ Chlorinated – Lower 1/3 of screened interval
 - ◆ Heterogonous conditions
 - ◆ Sample location should be based on the boring log and nature of contaminant being evaluated.

Low-flow Purging Method

Sampling Location (cont.)

- Screened interval > 20 feet – Must identify target zones based on boring logs and the sites hydrogeology. If target zone cannot be identified, sampling multiple depths may be necessary.

Low-flow Purging Method

Flow Rate

- The flow rate used during purging must be low enough to avoid increasing the water turbidity and minimize drawdown.
- The flow must be adjusted to obtain stabilization of the water level in the well as quickly as possible.
- The maximum flow rate used should not exceed 1 liter per minute (0.26 gpm).

Low-flow Purging Method

Measurement of Water Level and Drawdown

- Measurement of the water level in the well during purging is important when establishing the optimum flow rate for purging.
- The goal is to achieve a stabilized pumping water level as quickly as possible with minimal drawdown

Low-flow Purging Method

Indicator Parameters

- Continuous monitoring of water quality indicator parameters is required to determine when purging is completed and sampling should begin.
- Measurements must start when purging begins.
- Stabilized values should be met prior to sampling.
- The use of an in-line flow cell (closed) system is recommended for measuring indicator parameters, except for turbidity.

Low-flow Purging Method

Stability Criteria for Low-Flow Purging	
Constituent	Criteria
Dissolved Oxygen Content (DO)	± 0.2 mg/l
Oxidation-Reduction Potential (redox)	± 20 mv
Turbidity	± 10 %
Specific Conductance	± 3 -5% of reading
Temperature	± 3 % of reading (min. of $\pm 0.2^{\circ}\text{C}$)
pH	± 0.2 units

Low-flow Purging Method

Equipment Requirements

- The same pumping device used for purging will be used for sampling (i.e., the pump should be left in place after purging).
- Pump must be able to pump at rates equal to or less than 1 liter per minute.

Low-flow Purging Method

Equipment Requirements (cont.)

- Continuous water-level measurement devices (0.01-foot accuracy).
- An in-line flow cell (closed) monitoring system to measure (dissolved oxygen content, redox potential, specific conductance, temperature, and pH) and a separate field nephelometer for turbidity.

Low-flow Purging Method

Key Problems Observed

- Not placing the pump at the proper depth.
- Not allowing well to stabilize after the pump was placed into the well.
- Not adhering to the pumping rate and drawdown limitations.
- Not using the required monitoring criteria for determining stability.
- Not providing detailed field logs with the continues measurements of pumping rates and field stability measurements.

Low-flow Purging Method

Conclusion

- Not following the approved procedures for purging and sampling will result in rejection of the work and any reports generated.
- If work and reports are rejected they will most likely not be reimbursable by the State.